spoke strongly against the theory. The investigation of the electrolytic tension of decomposition of the ammonium salts with a mercury cathode, by Coehn and Dannenberg (*Zeitschrift für anorganische Chemie*, 25, 430), has given results perfectly analogous to those obtained with salts of the alkali metals, a result only explicable on the assumption of the ammonium theory. Experiments carried out under varying conditions to ascertain the possibility of reducing the heavy metals from their solutions, show that the negative results previously obtained are due to the great instability of the ammonium amalgam. By preparing the amalgam electrolytically at low temperatures (0° C.), when it appears to be much more stable and does not exhibit, to any great extent, the spongy appearance peculiar to the amalgam prepared under ordinary conditions, and allowing it to act on cold solutions of copper, cadmium and zinc salts, the formation of the corresponding heavy metal amalgams is easily observed. In the case of the copper, it might be possible to explain the reduction by attributing it to the nascent hydrogen generated in the decomposition of the ammonium amalgam; but this explanation is not possible in the case of the cadmium and zinc salts.

THE additions to the Zoological Society's Gardens during the past week include a Bonnet Monkey (*Macacus sinicus*) from India, presented by Mr. R. F. Wilson; a Polecat (*Mustela putorius*), British, presented by Mr. Hett; three Painted Snipe (*Rhynchaea capensis*) from India, presented by the Hon. Walter Rothschild, M.P.; a Tawny Owl (*Syrnium aluco*), European, presented by Mr. F. Medcalf; a Deville's Tamarin (*Midas devillii*) from Peru, a —— Conure (*Conurus ocularis*), an Orange-winged Amazon (*Chrysotis amazonica*), a Brazilian Tortoise (*Testudo tabulata*) from South America, three Japanese Pheasants (*Phasianus versicolor*) from Japan, two Pennant's Parrakeets (*Platycercus elegans*), a King Parrot (*Aprosmictus cyanopygius*) from Australia, deposited.

OUR ASTRONOMICAL COLUMN.

ORIGIN OF TERRESTRIAL MAGNETISM.—The *Observatory* for January contains a translation by Prof. L. A. Bauer, of the U.S. Geodetic Service, of an article in *Ciel et Terre*, December 16, 1900, containing the results obtained by Dr. Schmidt from an important harmonic analysis of the permanent magnetic field of the earth. This work has been practically an amplification of Gauss' "Théorie générale du magnétisme terrestre."

In Schmidt's analysis he does not assume the existence of an interior potential function governing the entire magnetic force; but adjusting separately each of the three rectangular components, obtains three expressions in place of the one determined by Gauss; moreover, the computations have been carried to the terms of sixth order instead of the fourth. He concludes that the magnetic force of the earth consists of three parts:—

(1) *The greatest part*, attributed to causes situated in the terrestrial crust, and having a potential.

(2) *The smallest part* (about one-fortieth the whole), due to causes exterior to the crust, and also possessing a potential.

(3) A part, somewhat greater than (2), not represented by a potential, and therefore indicating the existence of *vertical* terrestrial electric currents.

Dr. Schmidt has also made careful examinations of the records of magnetic storms. In that of February 28, 1896, which was observed at fifteen observatories, and lasted from 6-7 o'clock, he finds that the directions of disturbance vary considerably, at times converging to a point, at others radiating from a point; while at certain periods of comparative calm the lines of force were practically parallel, suggesting a distant centre of force. Taking these facts in consideration with the vertical component disturbances, he concludes that the causes producing terrestrial magnetic storms are for the most part exterior to the surface of the earth.

OPPOSITION OF MARS IN 1888.—Signor G. V. Schiaparelli has recently published a sixth volume of observations of Mars, containing the discussion of his determinations on the topography and constitution of the planet during the opposition of 1888, made with the 18-inch Merz refractor at the Milan Observatory. After preliminary notes of instrumental details and tables showing varying size of the disc, atmospheric quality, &c., about eighty pages are devoted to the detailed description of the aspects of the many markings recognised during the period, very many comparisons with the work of other observers being included; the remainder of the volume is occupied with the discussion of observations bearing on the constitution of the surface, giving detailed measures and descriptions of the varying polar caps, and a comparative analysis of the gemination of the principal "*canali*." Reproductions of drawings of the surface markings on successive dates are included, and two polar charts showing the whole of the observed phenomena in their relative longitudes.

DOUBLE STAR MEASURES.—In the *Astronomische Nachrichten* (Bd. 154, No. 3679) Mr. J. Comas Sola gives a series of measures of seventy-five double stars observed at Barcelona.

SCIENTIFIC DEVELOPMENTS OF BIOLOGY AND MEDICINE.

AN interesting monograph is just to hand in the shape of a lecture, delivered by Dr. Oscar Hertwig upon the occasion of the congress of German naturalists at Aix la Chapelle (Aachen). The subject is the development of biology in the nineteenth century. Many interesting points, forming landmarks in the progress of biological science, are discussed by the lecturer. The microscope, from the inestimable service it has rendered to morphology, must rank high in the discoveries of the century. Before morphological method had been enriched by it, the cellular hypothesis, which is the foundation stone of all biology, was impossible. Dr. Hertwig accentuates the fact that progress consists, not only in adding facts to our treasury of knowledge, but also in stamping out error, and that some of the biological energy of the nineteenth century has been consumed in annihilating the doctrine of spontaneous generation; it was, indeed, only Pasteur's researches that established irrefutably the dictum *Omne vivum e vivo*, and much later still did the corollary of this, namely *Omnis cellula e cellula*, firmly plant itself upon biology, never to be uprooted.

A further factor of transcendental importance in the progress of biology during the nineteenth century was the birth and growth of the study of embryology. Its chief result was the theory of evolution and the accompanying doctrines of natural selection and the survival of the fittest. The lecturer enters fully into the literature of this subject, which has moved the biological world perhaps more than any preceding one. The concluding part of the discourse is devoted to the progress made in that department of biology which we know as physiology. The attempt in this direction during the latter part of the century has been to reduce, by means of physico-chemical technique, biological phenomena to physico-chemical law. This attempt, although it has given us an enormous insight into the processes of life and has enabled us to formulate laws of the highest abstract and utilitarian value, has been, in its absolute sense, unsuccessful. It is doubtful if chemical and physical law can ever explain fully the phenomena of life, and while physiological chemistry and physics have destroyed the old vitalism, we are, to some extent, compelled to take refuge in a new one. From the practical standpoint, great progress has been made in the development of pharmacology and experimental pathology. The former, going hand in hand, as it ever must, with the practical treatment of disease, has not only thrown light upon many problems of pathology and physiology, but has greatly increased the possibilities of therapeutics, and given distinct hope for the future in this direction. Under experimental pathology serum therapy is included, and the immense field for research this has opened up.

An address delivered by Dr. Naunyn, of Strassburg, at the same congress, is of considerable interest. He chose for his subject the development of medicine, hygiene and bacteriology during the nineteenth century. To show the condition of medical thought at the beginning of the century, he quotes from the work of Prof. Kieser, of Jena, in 1812. At that time the exanthemata were regarded as necessary stages in the growth of mankind, and as essential to his perfect development, just as the pupa stage is essential to the butterfly. The scientific development of medicine, according to Prof. Naunyn, took its first real

impetus from the work of Johannes Müller. His text-book of physiology was a book which focussed the work of preceding generations for the purpose of pointing out the direction which the work of succeeding generations should take. This, and the subsequent discoveries of Laennec, formed the first scientific basis of medicine. The next step forward was the founding and development of morbid anatomy, going hand in hand with clinical medicine; in fact, any further progress of the latter without the former was impossible. In this respect the Vienna School, as exemplified by the clinician Skoda, working in connection with the pathologist Rokitansky, did giant service. Subsequently the researches of Pasteur, upon fermentation, and the antiseptic work of Lister form striking monuments in the century's progress. The latter was of value, according to the author, in a somewhat unanticipated direction, in that it rendered explorative operations possible, and thus enabled clinicians to observe disease in a stage short of that which it presented at the post-mortem examination. Last, but not least, Prof. Naunyn refers to the rise and the progress made by pharmacology, and points out the brilliant therapeutical results which have issued from pharmacological research.

THE DISTRIBUTION OF VERTEBRATE ANIMALS IN INDIA, CEYLON AND BURMA.[1]

THE completion of the seven volumes containing descriptions of all the vertebrata, in the "Fauna of British India," affords an opportunity of reviewing generally the distribution of terrestrial vertebrate animals throughout the British possessions in India, Ceylon and Burma.

For the study of zoological distribution there are few, if any, regions on the earth's surface that exceed British India and its dependencies in interest. The area is about 1,800,000 square miles, and although the vertebrate fauna is by no means thoroughly explored, it is well known throughout the greater part of the area and fairly known throughout the whole, better, probably, than in any other tropical and sub-tropical tract of approximately equal extent. The variety of climate is remarkable; within the area are included the almost rainless deserts of Sind and the locality on the Khási Hills, distinguished by the heaviest rainfall known, the cold, arid plateau of the Upper Indus drainage, and the damp tropical forests of Malabar and Tenasserim. The country is bounded on the north by the highest mountain range in the world and on the south by an ocean extending to the Antarctic regions. Another element of interest lies in the fact that the peninsula of India is a land of great geological antiquity, there being no evidence that it has ever been submerged, although the greater part of the Himalayas and Burma have at times been beneath the sea.

The plan adopted for the study has been to divide the whole country into nineteen tracts, distinguished by physical characters —such as rainfall, temperature, presence or absence of forests, and prevalence of hilly ground, and to construct tables showing the distribution of each genus of land or fresh-water vertebrate in the tracts. Genera have been selected for consideration because families and sub-families are too few in number and too wide in range, whilst species are too numerous and too unequal in importance. In the demarcation of regions and sub-regions, terrestrial mammalia are regarded as of primary importance.

The tracts are the following:—

A. *Indo-Gangetic Plain.*

1. Punjab, Sind, Baluchistan and Western Rajputana.
2. Gangetic Plain from Delhi to Rajmahal.
3. Bengal from Rajmahal to the Assam Hills.

B. *Indian Peninsula.*

4. Rajputana and Central India as far south as the Nerbudda.
5. Deccan from the Nerbudda to about 16° N. lat. and from the Western Ghats to long. 80° E.
6. Behar, Orissa, &c., from the Gangetic Plain to the Kistna.
7. Carnatic and Madras, south of 5 and 6, and east of the Western Ghats.
8. Malabar Coast, Concan and Western Ghats or Sahyádri range from the Tapti River to Cape Comorin.

C. *Ceylon.*

9. Northern and Eastern Ceylon.
10. Hill Ceylon, the Central, Western and Southern Provinces.

D. *Himalayas.*

11. Western Tibet and the Himalayas above forest.
12. Western Himalayas from Hazára to the western frontier of Nepal.
13. Eastern Himalayas, Nepal, Sikhim, Bhutan, &c.

E. *Assam and Burma.*

14. Assam and the hill ranges to the south with Manipur and Arrakan.
15. Upper Burma, north of about 19° N. lat.
16. Pegu from the Arrakan Yoma to the hill ranges east of the Sittang.
17. Tenasserim as far south as the neighbourhood of Mergui.
18. South Tenasserim, south of about 13° N. lat.
19. Andaman and Nicobar Islands.

A review of the fauna of these tracts leads to the following conclusions:—

(1) The Punjab tract differs greatly in its fauna from the Indian Peninsula and from all countries to the eastward, so greatly that it cannot be regarded as part of the Indo-Malay or Oriental region. Of terrestrial mammals, bats excluded, 30 genera are met with, of which 8 or 26½ per cent. are not Indian, whilst of reptiles (omitting crocodiles and chelonians) 46 genera occur, and of these 20 or 43½ per cent. are unknown further east. Of the corresponding orders of mammalia 46, and of reptiles 80 genera occur in the Peninsula, and 24 or 52 per cent. of the former and 57 or 64 per cent. of the latter are not found in the Punjab tract. All the genera met with in the Punjab tract and wanting further east are either Holarctic forms or peculiar, but with Holarctic affinities.

The Punjab, Sind and Western Rajputana are in fact the eastern extremity of the area known as the Eremian or Tyrrhenian or Mediterranean sub-region, generally regarded as part of the Holarctic region, but by some classed as a region by itself corresponding to the Sonoran in North America.

(2) The Himalayas above the forests and such portions of Tibet as come within Indian political limits (Gilgit, Ladák, Zanskar, &c.) belong to the Tibetan sub-region of the Holarctic region. Of twenty-five mammalian genera hitherto recorded from No. 11 (the Tibetan) tract, 11 or 44 per cent. are not found in the Indo-Malay region. That Tibet forms a distinct mammalian sub-region has already been shown in other papers.

(3) India proper from the base of the Himalayas to Cape Comorin, and from the Arabian Sea and the eastern boundary of the Punjab tract to the Bay of Bengal and the hills forming the eastern limit of the Gangetic alluvium, should, with the addition of the island of Ceylon, be regarded as a single sub-region, and may be conveniently entitled the Cisgangetic sub-region. The forests of the Sahyádri range and of the western, or Concan and Malabar, coast and the hill area of Southern Ceylon have a far richer fauna than the remaining area, but are not sufficiently distinct to require sub-regional separation.

The Cisgangetic sub-region is distinguished from the Transgangetic by the presence amongst mammals of Hyænidæ, Erinaceinæ, Gerbillinæ, of three peculiar genera of antelopes and of some other types; amongst birds by the occurrence of Pterocletes (sand grouse), Phœnicopteri (flamingoes), Otididæ (bustards) and Cursoriinæ; amongst reptiles by the possession of the families Eublepharidæ, Chamæleontidæ and Uropeltidæ, together with many peculiar Geckonidæ, Agamidæ, Lacertidæ and Scincidæ, and amongst batrachians by about one-half of the genera found in each sub-region being absent in the other. The difference between the reptiles and batrachians by itself would justify the classification of the two areas as distinct regions, a view adopted by several writers.

The difference between the Cisgangetic vertebrate fauna and that inhabiting the rest of the Indo-Malay or Oriental region is partly due to the absence in the former of numerous Eastern types, and partly to the presence of two constituents besides the Oriental genera, which, especially in forest, form a majority of the animals present. One of these two constituents consists of mammals, birds and reptiles having a distinct relationship with Ethiopian and Holarctic genera, and with the Pliocene

[1] Abridged from a paper read at the Royal Society, on December 13, 1900, by Dr. W. T. Blanford, F.R.S.